



GVPM Thermal Management Overview

Mr. Chris Spangler and Ms. Mary Goryca

11 Aug 2011

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 11 AUG 2011		2. REPORT TYPE Briefing Charts		3. DATES COVERED 08-03-2011 to 08-07-2011	
4. TITLE AND SUBTITLE Ground Vehicle Power and Mobility Thermal Management Overview				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Chris Spangler; Mary Goryca				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army TARDEC, 6501 East Eleven Mile Rd, Warren, Mi, 48397-5000				8. PERFORMING ORGANIZATION REPORT NUMBER #22027	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army TARDEC, 6501 East Eleven Mile Rd, Warren, Mi, 48397-5000				10. SPONSOR/MONITOR'S ACRONYM(S) TARDEC	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S) #22027	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES For GROUND VEHICLE SYSTEMS ENGINEERING AND TECHNOLOGY SYMPOSIUM (GVSETS), SET FOR AUG 2011					
14. ABSTRACT Any system that generates or consumes power rejects heat. This heat is typically not considered as a significant design factor when integrating on a platform. Most military engine cooling systems are under-designed as a result negatively impact mobility functions. Internal combustion is the only source of power on all military vehicles. There are no other alternative energy sources on any military vehicles. Soldiers are routinely exposed to elevated in-cabin temperatures (above 85F), consequently their ability to complete the mission is negatively impacted.					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Public Release	18. NUMBER OF PAGES 5	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

Thermal Management

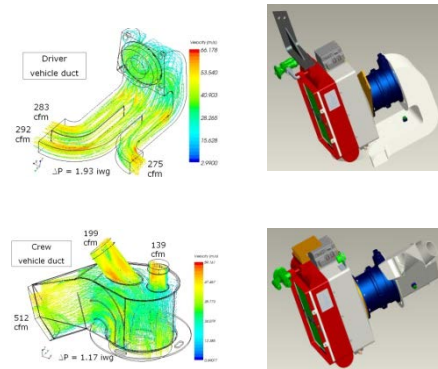
GVSETS
GROUND VEHICLE SYSTEMS ENGINEERING AND TECHNOLOGY SYMPOSIUM

Challenges we have:

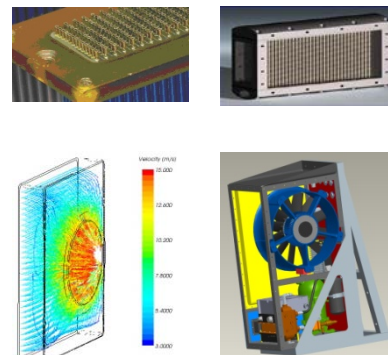
- Any system that generates or consumes power rejects heat. This heat is typically not considered as a significant design factor when integrating on a platform.
- Most military engine cooling systems are under-designed as a result negatively impact mobility functions.
- Internal combustion is the only source of power on all military vehicles. There are no other alternative energy sources on any military vehicles.
- Soldiers are routinely exposed to elevated in-cabin temperatures (above 85F), consequently their ability to complete the mission is negatively impacted.

Solutions we are investigating:

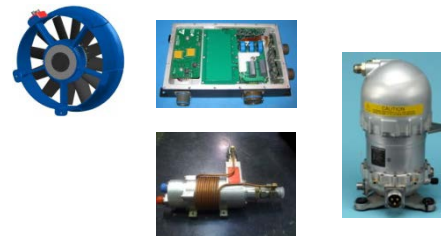
Redesigning More Efficient In-Vehicle Air Flow Paths and Air Handling Units (AHU) Using Computational fluid Dynamics (CFD) and Modeling and Simulation (M&S)



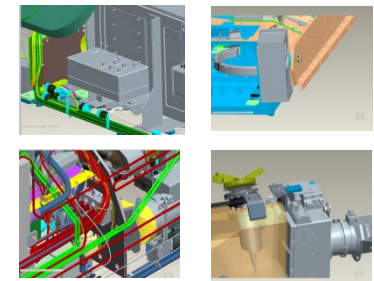
Advanced Heat Exchanger Design, Development, and Testing in New Vapor Compression System



Development of High Voltage Electrically Driven Components (Fans, Pumps, Valves and Controllers) that Support Electrification of Thermal Management Systems



Thermoelectric modules to be incorporated into exhaust or engine compartment

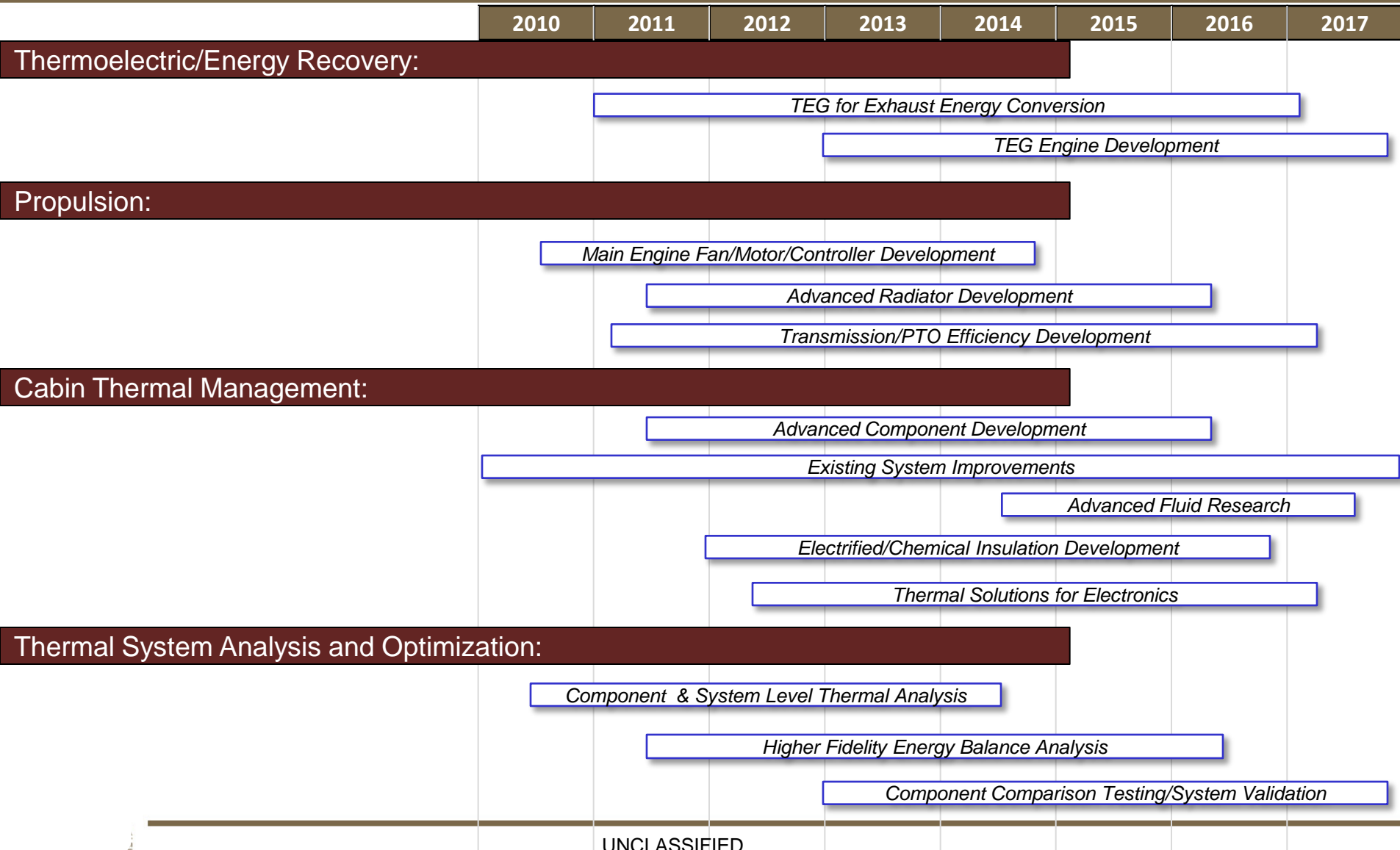


Where we need your help:

- Innovations in: Improved system performance, thermal component efficiency, reduce fan power consumption, reduce component size and weight, minimize waste heat, efficient techniques to move and manage heat
- Existing energy balance and thermal optimization tools
- Advanced fluid research for cabin thermal management and/or propulsion cooling

Projects Current & Future

GVSETS
GROUND VEHICLE SYSTEMS ENGINEERING AND TECHNOLOGY SYMPOSIUM



Laboratory Capability Current & Future

GVSETS
GROUND VEHICLE SYSTEMS ENGINEERING AND TECHNOLOGY SYMPOSIUM

Current Capability



- Air Filtration Test Bench
- Vehicle Radiator Evaluation



- Thermoelectric Bench Testing



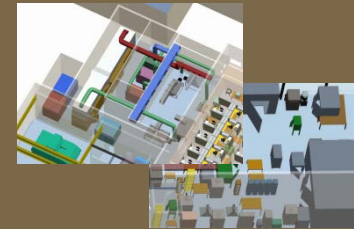
- Full Load Cooling Test
- Cabin Cooling Evaluation

GSPEL

Ground Systems Power
and Energy Laboratories

**TM
Roadmap**

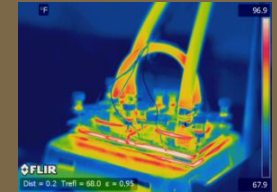
Future Capability



- Air Filtration Test Bench
- Vehicle Radiator Evaluation

- Thermoelectric Validation Testing

- System Level Thermal Management Analysis



- Full Load Cooling
- Cold-start / operation
- Cabin Heating and Cooling Evaluation

- Labs
 - Building 212 – vehicle level testing
 - Building 7 – limited component testing
- Capability to test components for verify against standards
- Small scale thermoelectrics
- Sub-system HVAC validation

- Labs
 - Building 212 – maintain test capabilities
 - GSPEL – relocated Building 7 testing and increase capability
- Capability to test components at a sub-system level for validation of supplied/modeled data
- Increase operating range and analyze thermal from system level

Energy Usage

(For average representative platform under one specific steady state point)

GVSETS
GROUND VEHICLE SYSTEMS ENGINEERING AND TECHNOLOGY SYMPOSIUM

Energy from Fuel

